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ABSTRACT:

PROBLEM TO BE SOLVED: To provide an endoscope not liable to be damaged or broken even by repeated use and having a small curved surface resistance.

SOLUTION: The endoscope comprises an insertion part 2 having flexibility (pliability), and a control unit installed at the proximal end of the insertion part 2. The part 2 is constituted by arranging an elongated member such as a tube, a wire or the like in a tuke constituted of a pellicle 382 or the like. A lubricant 5 is arranged in the tuke, and a coating layer 4 constituted of a polyparaxylylene resin is formed on an inner surface of the tuke and the front surface of the long-sized member. As the polyparaxylylene resin, the resin containing at least one type selected from the group consisting of a polyparaxylylene and a monochloroparaxylylene is preferred. A thickness of the coating layer is preferred to be 0.1 to 75 ×m.

CLAIMS

[Claim(s)]

[Claim 1] The endoscope which is an endoscope which has a lumen, the long member arranged in the inside, and the lubricant arranged in the inside of said lumen, and is characterized by forming the enveloping layer of the inside of said lumen, and/or the surface of said member which consisted of poly PARAKISHIRIREN resin in part at least.

[Claim 2] Said long member is the endoscope according to claim 1 which can move relatively to said lumen.

[Claim 3] Said lubricant is an endoscope according to claim 1 or 2 which is the thing containing at least one sort in fluoridation carbon, boron nitride, black lead, and fluororesin.

[Claim 4] Said lubricant is an endoscope according to claim 1 to 3 which is the thing containing powder lubricant.

[Claim 5] The average particle diameter of said powder lubricant is an endoscope according to claim 4 which is 0.01-20 micrometers.

[Claim 6] Said lubricant is an endoscope according to claim 1 to 5 which are silicone gel and the thing containing at least one sort in grease.

[Claim 7] Said lubricant is an endoscope according to claim 1 to 6 arranged on the circumference of said member.

[Claim 8] Said poly PARAKISHIRIREN resin is an endoscope according to claim 1 to 7 which is the thing containing at least one sort in poly monochloro PARAKISHIRIREN and poly PARAKISHIRIREN.

[Claim 9] Said long member is an endoscope according to claim 1 to 8 which is a wire.

[Claim 10] Said long member is an endoscope according to claim 1 to 9 which is a tube.

[Claim 11] As for said long member, said lubricant is the endoscope according to claim 1 to 10 with which it is an optical fiber bunch and the surface is allotted in part at least outside said optical fiber bunch.

[Claim 12] Said long member is an endoscope according to claim 1 to 11 with which the surface is allotted in part at least outside each optical fiber with which it is an optical fiber bunch and said lubricant constitutes said optical fiber bunch.
[Claim 13] As for said long member, the enveloping layer which is an optical fiber bunch and consisted of poly PARAKISHIRIREN resin is the endoscope according to claim 1 to 12 with which the surface is formed in part at least outside said optical fiber bunch.
[Claim 14] Said long member is an endoscope according to claim 1 to 13 with which the surface is formed in part at least outside each optical fiber with which it is an optical fiber bunch and the enveloping layer which consisted of poly PARAKISHIRIREN resin constitutes said optical fiber bunch.
[Claim 15] The thickness of said enveloping layer is an endoscope according to claim 1 to 14 which is 0.1-75 micrometers.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an endoscope.
[0002]
[Description of the Prior Art] In the field of medical, the endoscope is used for inspection of an alimentary canal etc., diagnosis, etc. This endoscope has the insertion part inserted into the abdominal cavity, and the final controlling element which is installed in the end face side of this insertion part, and carries out curve operation of the tip part of an insertion part. Moreover, this endoscope is installed from a final controlling element, and it has the terminal area connected to light equipment or a control device.
[0003] An insertion part is inserted into the crooked abdominal cavity, and it has the flexible tube which has flexibility, and the bent side by which curve operation is carried out at the tip side so that this can be followed.
[0004] By the way, the curve mechanism in which the bent side which exists in the direction of a tip is incurvated to these insertion circles, Long members, such as ****, a liquid-sending tube, etc. which pours in the tube which inserts in the forceps which conducts the Rheydt guide which transmits the light from said light equipment to a tip part, image guide which transmits a photographic subject's picture to a final controlling element, medical treatment, cytoscopy, etc., a medical fluid, etc., are arranged in the longitudinal direction if needed.
[0005] And if this flexible tube and bent side are incurvated, friction will arise in each long member built in by having made it curve, and pressure will act. In order to protect each long member from this friction and pressure, lubricant was conventionally arranged on the surroundings of each long member.

[0006] By the way, since repetition use is carried out, such an endoscope needs to perform washing and sterilization each time.

[0007] The lubricant used conventionally had the problem of deteriorating and deteriorating, by such sterilization processing. Deterioration of such lubricant and degradation become a lubricative fall and the cause of failure of an endoscope.

[0008] Moreover, even if it excels in chemical resistance and performs such sterilization processing, the lubricant which hardly deteriorates and deteriorates is also known, but when such lubricant is used, sufficient lubricity is not obtained by the use of an endoscope etc., but sliding resistance is strong. It might be damaged and especially the optical fiber (optical fiber) that constitutes the Rheydt guide and an image guide might be damaged, when sufficient lubricity was not obtained.

[0009]

[Problem to be solved by the invention] Even if the purpose of this invention has small curve resistance and it uses it repeatedly, there is in offering the endoscope which does not produce damage and breakage easily.

[0010]

[Means for solving problem] Such a purpose is attained by this invention of following the (1) - (15).

[0011] (1) The endoscope which is an endoscope which has a lumen, the long member arranged in the inside, and the lubricant arranged in the inside of said lumen, and is characterized by forming the enveloping layer of the inside of said lumen, and/or the surface of said member which consisted of poly PARAKISHIRIREN resin in part at least.

[0012] Even if curve resistance is small and uses it by this repeatedly, the endoscope which does not produce damage and breakage easily can be offered.

[0013] (2) Said long member is an endoscope given in the above (1) which can move relatively to said lumen. Thereby, curve resistance of an endoscope becomes still smaller.

[0014] (3) Said lubricant is an endoscope the above (1) which is the thing containing at least one sort in fluoridation carbon, boron nitride, black lead, and fluororesin, or given in (2).

[0015] Curve resistance of an endoscope becomes still smaller by this, and chemical resistance improves.

[0016] (4) Said lubricant is an endoscope the above (1) which is the thing containing powder lubricant, or given in either of (3).

[0017] While the handling of lubricant becomes easy by this, curve resistance of an endoscope becomes still smaller.

[0018] (5) The average particle diameter of said powder lubricant is an endoscope given in the above (4) which is 0.01-20 micrometers. Thereby, curve resistance of an endoscope becomes still smaller.

[0019] (6) Said lubricant is an endoscope the above (1) which is silicone gel and the thing containing at least one sort in grease, or given in either of (5).
[0020] While the handling of lubricant becomes easy by this, it becomes possible to protect the long member arranged in the inside of a lumen from a shock etc.
[0021] (7) Said lubricant is an endoscope the above (1) allotted to the circumference of said member, or given in either of (6). Thereby, curve resistance of an endoscope becomes still smaller.
[0022] (8) Said poly PARAKISHIRIREN resin is an endoscope the above (1) which is the thing containing at least one sort in poly monochloro PARAKISHIRIREN and poly PARAKISHIRIREN, or given in either of (7). Thereby, at least one side improves the pliability of an endoscope, and among chemical resistance.
[0023] (9) Said long member is an endoscope the above (1) which is a wire, or given in either of (8).
[0024] Thereby, a wire can be smoothly towed now and the operativity of curve operation of an endoscope and flattery nature improve.
[0025] (10) Said long member is an endoscope the above (1) which is a tube, or given in either of (9).
[0026] Thereby, it can prevent more effectively that the long member in a lumen is damaged and damaged.
[0027] (11) Said long member is an endoscope given in the above (1) on which it is an optical fiber bunch and said lubricant is arranged for the surface in part at least outside said optical fiber bunch, or either of (10).
[0028] Thereby, it can prevent more effectively that an optical fiber bunch is damaged and damaged.
[0029] (12) Said long member is an endoscope given in the above (1) to which the surface is allotted in part at least outside each optical fiber with which it is an optical fiber bunch and said lubricant constitutes said optical fiber bunch, or either of (11).
[0030] Thereby, it can prevent more effectively that an optical fiber bunch is damaged and damaged.
[0031] (13) As for said long member, the enveloping layer which consisted of poly PARAKISHIRIREN resin is an endoscope given in the above (1) in which it is an optical fiber bunch and the surface is formed in part at least outside said optical fiber bunch, or either of (12).
[0032] Thereby, it can prevent more effectively that an optical fiber bunch is damaged and damaged.
[0033] (14) Said long member is an endoscope given in the above (1) in which the surface is formed in part at least outside each optical fiber with which it is an optical fiber bunch and the

enveloping layer which consisted of poly PARAKISHIRIREN resin constitutes said optical fiber bunch, or either of (13).

[0034] Thereby, it can prevent more effectively that an optical fiber bunch is damaged and damaged.

[0035] (15) The thickness of said enveloping layer is an endoscope the above (1) which is 0.1-75 micrometers, or given in either of (14). Thereby, curve resistance of an endoscope becomes still smaller.

[0036]

[Mode for carrying out the invention] The endoscope of this invention is hereafter explained in detail based on the suitable embodiment shown in an accompanying drawing.

[0037] [the whole figure in which drawing 1 shows the embodiment of the endoscope (fiberscope type) of this invention, and drawing 2] The longitudinal section of the bent side in the endoscope which the transverse cross section of the flexible tube in the endoscope shown in drawing 1 and drawing 3 show to drawing 1 , and drawing 4 are the expanded sectional views expanding and showing a part of longitudinal section (near the central part of the optical fiber bunch which constitutes the Rheydt guide) shown in drawing 2 . Hereafter, the upper part is called "end face" among drawing 1 , and a lower part is called "tip."

[0038] As shown in drawing 1 , the endoscope 1 of this invention has the insertion part 2 of a long thing which has flexibility (pliability), and the final controlling element 7 installed in the end face side of the insertion part 2. A final controlling element 7 is a portion which a way person grasps and operates the endoscope 1 whole.

[0039] As shown in drawing 1 , the final controlling element 7 has the final controlling element main part 71 and the final controlling element cover 72 which form the outer wall, a curve operation mechanism for carrying out curve operation (crookedness operation) of the bent side 21 mentioned later remotely, and **** and the liquid-sending channel which introduce the fluid supplied to the tip part of the insertion part 2. The curve control lever 73 for performing the curve operation is supported free [rotation] by the final controlling element main part 71.

[0040] The eye contacting part 8 is formed in the head (end face side) of the final controlling element main part 71. By this eye contacting part 8, direct observation of a photographic subject's picture can be carried out. Moreover, this eye contacting part 8 can be connected now to the camera (not shown) which contains CCD (image sensor), an image pick-up optical system, etc. free [attachment and detachment]. For this reason, a photographic subject is also observable as a monitor picture.

[0041] Moreover, the flexible Rheydt guide flexible tube 9 in which the Rheydt guide 32 mentioned later is inserted is connected to the supporter [of the curve control lever 73 in the final controlling element main part 71], and opposite side. The connector 10 connected to the light equipment which is not illustrated is connected with the tip part of this Rheydt guide

flexible tube 9.

[0042] The insertion part 2 is used inserting into the abdominal cavity. As shown in drawing 1 , the insertion part 2 has the bent side 21 which can curve from the hand (end face) side to its flexible tube 20 and tip side (crookedness). And the tip part 22 is formed at the tip of this bent side 21, and the latest part 23 is further formed at that tip.

[0043] As shown in drawing 2 , in the insertion part 2, the image guide 31, the Rheydt guide 32, the tube 33 for forceps insertion, the tube 34 for ****, and the tube 35 for liquid sending are arranged in the inside of the outside pipe 24 (lumen) along with the longitudinal direction.

[0044] Each of these long members (the image guide 31, the Rheydt guide 32, the tube 33 for forceps insertion, the tube 34 for ****, and tube 35 for liquid sending) are isolated, and are protected from the exterior by the outside pipe 24. Furthermore, the outside pipe 24 prevents that the substance in contact with the surface of the insertion part 2, for example, medicine, humors, etc., permeates the inside of the insertion part 2, and protects each part material in the insertion part 2. The outside [this] pipe 24 is making the layer structure where wire insertion **** 37, the inner skin 381, and an outer cover 382 were laminated, sequentially from the inner side.

[0045] As for an outer cover 382, it is desirable to consist of material which has pliability (flexibility) in order to prevent inflicting damage on the organization in the abdominal cavity by friction. As a component of an outer cover 382, for example Polyvinyl chloride, polyethylene, Polyolefin system resin, such as polypropylene and an ethylene-vinyl acetate copolymer, Polyester system resin, such as polyamide system resin, polyethylene terephthalate (PET), and poly butylene terephthalate, Polyurethane system resin, polystyrene system resin, poly tetrafluoro ethylene, The resin which has various flexibility, such as fluororesin, such as an ethylene tetrafluoro ethylene copolymer, and polyimide system resin, A polyurethane system elastomer, a polyester system elastomer, a polyolefin system elastomer, It can use combining one sort or two sorts or more in various elastomers, such as a polyamide system elastomer, a polystyrene system elastomer, a fluorinated elastomer, silicone rubber, and latex rubber.

[0046] The thickness of an outer cover 382 can protect the various members in the insertion part 2, and especially if the flexibility and the curve nature of the insertion part 2 are not barred, it will not be limited, but its about 100-3000 micrometers are desirable, and its about 200-1000 micrometers are more desirable.

[0047] Next, the long member (the image guide 31, the Rheydt guide 32, the tube 33 for forceps insertion, the tube 34 for ****, tube 35 for liquid sending) arranged in the inside of the outside pipe 24 is explained.

[0048] The image guide 31 transmits a photographic subject's picture to an eye contacting part 8. This image guide 31 consists of an optical fiber bunch and a protection tube (the 1st protection tube 311 and the 2nd protection tube 312) for protecting this optical fiber bunch.

[0049] The optical fiber bunch consists of two or more optical fiber 6 (optical fiber). In the both ends of an eye contacting part 8 and the latest part 23, it bundles with adhesives, and is fixed, and each optical fiber 6 is in the state which each optical fiber 6 can move separately in other portions. Thereby, the cross section form of the image guide 31 of those other than both ends can change if needed.

[0050] As shown in drawing 3 , the object lens 39 is installed in the latest part 23 of the insertion part 2. The end (incidence end) of the image guide 31 is connected to this object lens 39.

[0051] This object lens 39 can make the incidence end of the image guide 31 carry out image formation of a photographic subject's picture.

[0052] The Rheydt guide 32 draws the light from the light source of the light equipment which was connected to the connector 10 and which is not illustrated, and is irradiated ahead of the latest part 23. Thereby, when observing a photographic subject, the required illumination light can be obtained.

[0053] This Rheydt guide 32 consists of an optical fiber bunch and a protection tube 321 for protecting this optical fiber bunch.

[0054] The optical fiber bunch consists of two or more optical fiber 6 (optical fiber). In the both ends of a connector 10 and the latest part 23, it bundles with adhesives, and is fixed, and each optical fiber 6 is in the state which each optical fiber 6 can move separately in other portions. Thereby, the cross section form of the Rheydt guide 32 of those other than both ends can change if needed.

[0055] The optical fiber 6 used for the image guide 31 and the Rheydt guide 32 is constituted by quartz, multi-ingredient glass, the plastic, etc.

[0056] Although the diameter in particular of the optical fiber 6 which constitutes these optical fiber bunch is not limited, its about 2-40 micrometers are desirable, and its about 4-10 micrometers are more desirable. The restoration nature of the lubricant 5 to optical fiber moment spare time may worsen that a diameter is said under lower limit. On the other hand, if a diameter exceeds said upper limit, the fall of pixel density and the efficiency of a light guide may worsen.

[0057] The tube 33 for forceps insertion is hollow structure, and forceps is inserted in here. With this forceps, an endoscope 1 is near the latest part 23, and can perform various disposal, medical treatment, etc.

[0058] In addition, you may insert other medical aid implements other than forceps, a diagnostic implement, etc. in this tube 33 for forceps insertion.

[0059] The tube 34 for **** and the tube 35 for liquid sending are wide opened at the tip of the insertion part 2, and can pour in fluid into the abdominal cavity by the tip opening, or can attract fluid from the inside of the abdominal cavity. For example, the humors near pouring or

the latest part 23 etc. are recoverable near the latest part 23 inserted and detained in the abdominal cavity with the tube 35 for liquid sending in the rinse water introduced from said **** and liquid-sending channel of the final controlling element 7, a medical fluid, etc.

[0060] Moreover, as shown in drawing 2 , the lumen is formed inside the outside pipe 24 and the enveloping layer 4 which consisted of poly PARAKISHIRIREN resin is formed in the inside of the outside [this] pipe 24. Moreover, the enveloping layer 4 is formed also in the surface of each long member (the image guide 31, the Rheydt guide 32, the tube 33 for forceps insertion, the tube 34 for ****, tube 35 for liquid sending) arranged in this lumen, and lubricant 5 is arranged on the inside of the outside pipe 24 (lumen). An enveloping layer 4 and lubricant 5 have the outstanding lubricity so that it may explain in full detail behind. For this reason, the frictional resistance between long member-long picture members when each long member moves relatively to the outside pipe 24 (lumen) (for example, when the insertion part 2 curves), and between outside pipe-long picture members will become small. Therefore, each long member is enabled to move smoothly and curve resistance of the insertion part 2 will become small. As a result, it becomes possible to prevent damage to each long member, breakage, etc. effectively.

[0061] Moreover, as shown in drawing 2 , the lumen is formed inside the protection tube 321 and the enveloping layer 4 is formed in the inside of this protection tube 321. Moreover, in this lumen, the optical fiber bunch is arranged as a long member. Furthermore, as shown in drawing 4 , the enveloping layer 4 is formed in the surface of each optical fiber 6 which constitutes this optical fiber bunch, and lubricant 5 is arranged on the circumference of each optical fiber 6.

[0062] Thus, by forming an enveloping layer 4 in the inside of the protection tube 321 which covers the surface and the optical fiber bunch of each optical fiber 6 which constitute the optical fiber bunch of the Rheydt guide 32, and arranging lubricant 5 on the circumference of each optical fiber 6 The frictional resistance between optical fiber 6-optical fiber 6 when optical fiber 6 moves relatively to the protection tube 321 (for example, when the insertion part 2 curves), and between the optical fiber 6-protection tubes 321 will become small. For this reason, each optical fiber 6 is enabled to move smoothly, and curve resistance of the insertion part 2 will become small. therefore, each optical fiber in the time of the curve of the insertion part 2 etc. -- it pulls, pressure and buckling are controlled and damage to the Rheydt guide 32, breakage, etc. can be effectively prevented as a result.

[0063] Moreover, an enveloping layer 4 and lubricant 5 are similarly arranged about the image guide 31. Thereby, the frictional resistance between optical fiber 6-optical fiber 6 when optical fiber 6 moves relatively to the 1st protection tube 311 (for example, when the insertion part 2 curves), and between the optical fiber 6-1st protection tubes 311 will become small. For this reason, each optical fiber 6 is enabled to move smoothly, and curve resistance of the insertion

part 2 will become small. therefore, each optical fiber in the time of the curve of the insertion part 2 etc. -- it pulls, pressure and buckling are controlled and damage to the image guide 31, breakage, etc. can be effectively prevented as a result.

[0064] The bent side 21 which built in such each long member rotates the curve control lever 73, and curves in the predetermined direction by towing a wire 36 and loosening (refer to drawing 3).

[0065] A pair of wires 36 are arranged so that it may counter in general through the main axis of the insertion part 2. Moreover, the wire 36 (long member) is inserted between wire insertion **** 37 and the inner skin 381 (inside of a lumen). The tip of this wire 36 is being pasted up and fixed to the portion by which the tip part 22 of the insertion part 2 was blockaded.

[0066] For this reason, if the curve control lever 73 is rotated, one wire 36 is towed and the wire 36 of another side is loosened, as shown in drawing 3 , a bent side 21 will curve to a side with the tip of that towed wire 36.

[0067] Moreover, the 360-degree all direction is observable by operating a final controlling element 7, rotating the insertion part 2 centering on an axis, and combining this and said curve.

[0068] It has the intensity and endurance which are the grade which does not produce disconnection by frequent traction operation on a wire 36, and what has few growth is used for it. As such a wire, the single tracks and the fiber bunches by a resin fiber, such as metal lines, such as stainless steel, polyamide, and polyester, are mentioned, for example.

[0069] Moreover, [an outer diameter] although the outer diameter of a wire 36 changes with terms and conditions, such as cross section form of the component and insertion part 2, a size, and a component When the wire 36 consists of single tracks of for example, the twist thread made from poly acrylate, or stainless steel, as for the outer diameter, about 30-3000 micrometers is desirable, and its about 100-1000 micrometers are more desirable.

[0070] Wire insertion **** 37 supports a wire 36 with the inner skin 381. When both support a wire 36, the wire 36 can curve smoothly in the appointed direction.

[0071] Wire insertion **** 37 and the inner skin 381 consist of material (for example, stainless steel etc.) which has the intensity and endurance which breakage does not produce, when a wire 36 can be supported and a wire 36 is towed.

[0072] The thickness of wire insertion **** 37 and the inner skin 381 can support a wire 36, and especially if the flexibility and the curve nature of the insertion part 2 are not barred, it will not be limited, but its about 100-3000 micrometers are desirable, and its about 100-200 micrometers are more desirable.

[0073] Moreover, the enveloping layer 4 is formed in the inside of a lumen (space formed with wire insertion **** 37 and the inner skin 381) and the surface of a wire 36 on which the wire 36 was inserted, and lubricant 5 is arranged on the inside of this lumen. Thereby, the frictional

resistance between the inside-wires of a lumen when a wire 36 (long member) moves relatively to this lumen (for example, when a wire 36 is towed) will become small. For this reason, curve resistance of the insertion part 2 becomes small, it becomes possible as a result to tow a wire 36 smoothly, and the operativity of curve operation of an endoscope 1 and flattery nature improve.

[0074] As explained above, this invention has the feature at the point of making the enveloping layer 4 which consisted of poly PARAKISHIRIREN resin, and lubricant 5 coexisting. An enveloping layer 4 and lubricant 5 are explained in full detail hereafter.

[0075] [Enveloping layer] The enveloping layer 4 consists of poly PARAKISHIRIREN resin. Such an enveloping layer 4 has an advantage as shown below.

[0076] 1. The enveloping layer 4 which consisted of lubricative poly PARAKISHIRIREN resin has the outstanding lubricity. Therefore, by forming an enveloping layer 4, curve resistance of the insertion part 2 can be reduced effectively, and, moreover, each part material can be effectively protected from damage by friction.

[0077] 2. The chemical-resistant insertion part 2 may be immersed in medicine, such as an antiseptic, before and after use. It reacted with such a medicine, and it deteriorated to conventional lubricant, or was corroded, and there were some which cannot bear long-term use in it.

[0078] On the other hand, the enveloping layer 4 which consisted of poly PARAKISHIRIREN resin is excellent in chemical resistance. For this reason, even if lubricant 5 contacts such a medicine, it deteriorates and it does not deteriorate easily.

[0079] Therefore, it becomes possible to use the endoscope 1 which has the enveloping layer 4 which consisted of poly PARAKISHIRIREN resin over a long period of time also under the environment where medicine, such as an antiseptic, is contacted daily, without deteriorating.

[0080] 3. The advanced sterilization which used the hydrogen peroxide system antibacterial etc. is presented with water repellence and the gas barrier nature insertion part 2. This hydrogen peroxide system antibacterial permeates the inside of the insertion part 2 easily, and tends to be adsorbed by rubber, resin, etc. For this reason, when such sterilization was repeated and presented with the insertion part 2, there was a problem that the member in the insertion part 2 deteriorated gradually.

[0081] However, the enveloping layer 4 which consisted of poly PARAKISHIRIREN resin is excellent in water repellence and gas barrier nature. For this reason, by forming such an enveloping layer, a hydrogen peroxide system antibacterial etc. becomes difficult to permeate an inside, and can prevent degradation of each part material.

[0082] Therefore, such an insertion part 2 repeats advanced sterilization, and becomes difficult to deteriorate as a line, and such sterilization can be repeatedly presented with it.

[0083] 4. Since the enveloping layer 4 which consisted of insulating poly PARAKISHIRIREN

resin has electric insulation, there is no restriction in the place which can be used in the insertion part 2, and it can be widely used for it. And thereby, the insulation of the insertion part 2 whole can be raised.

[0084] A short circuit etc. is not caused, when it is especially used for an electronic endoscope, for example, even if the enveloping layer 4 touches the terminal area of a lead, a lead, and CCD etc. And a short circuit, an electric shock, etc. can also be prevented.

[0085] Thus, the enveloping layer 4 which consisted of poly PARAKISHIRIREN resin has said four outstanding advantages, and the outstanding endoscope 1 which is later mentioned by the synergistic effect is offered.

[0086] As poly PARAKISHIRIREN resin which constitutes an enveloping layer 4 Poly PARAKISHIRIREN (poly-para-xylylene), poly monochloro PARAKISHIRIREN (poly-monochloro-para-xylylene), Poly dichloro PARAKISHIRIREN (poly-dichloro-para-xylylene), Although poly mono-fluoro PARAKISHIRIREN (poly-monofluoro-para-xylylene), poly monoethyl PARAKISHIRIREN (poly-monoethyl-para-xylylene), etc. are mentioned It is desirable that it is what contains at least one sort in poly PARAKISHIRIREN and poly monochloro PARAKISHIRIREN also especially in this. Especially poly PARAKISHIRIREN is excellent in pliability. Moreover, especially poly monochloro PARAKISHIRIREN is excellent in gas barrier property.

[0087] Such an enveloping layer 4 is usually formed by performing CVD (chemical vapor deposition), using the dimer corresponding to PARAKISHIRIREN resin as materials. Moreover, in advance of formation of an enveloping layer 4, you may perform ground processing of washing processing, blast processing, etching, etc. to the formation part of an enveloping layer. Thereby, the uniform and precise enveloping layer 4 is obtained by being stabilized.

[0088] Although the thickness in particular of an enveloping layer 4 is not limited, it is desirable that it is 0.1-75 micrometers, and it is more desirable that it is 0.5-20 micrometers. The effect of this invention may not fully be acquired as the thickness of an enveloping layer 4 is said under lower limit. On the other hand, if the thickness of an enveloping layer 4 exceeds said upper limit, pliability may fall.

[0089] [Lubricant] Lubricant 5 has the outstanding lubricity like said enveloping layer 4. In this invention, the especially excellent lubricity is obtained by making an enveloping layer 4 and lubricant 5 coexist.

[0090] Although the thing containing molybdenum disulfide (MoS2), boron nitride (BN), black lead, fluoridation carbon ((CF) n), fluororesin, etc. is mentioned as lubricant 5, for example It is desirable that it is the thing containing at least one sort in boron nitride (BN), black lead, fluoridation carbon ((CF) n), and fluororesin. Especially these lubricant is excellent in chemical resistance.

[0091] Although the form in particular of lubricant is not limited, it is desirable that it is the thing

containing powder. While the gap where lubricant 5 is narrow can also be entered as lubricant 5 is the thing containing powder lubricant, and being able to perform **** now more smoothly, it becomes easy [the handling of lubricant 5].

[0092] Although the average particle diameter in particular of powder lubricant is not limited, its about 0.01-20 micrometers are desirable, its about 0.1-16 micrometers are more desirable, and its about 1-14 micrometers are still more desirable. If average particle diameter exceeds the upper limit of this range, the restoration nature of lubricant 5 worsens and sufficient lubricity may not no longer be obtained. On the other hand, while a manufacture top is difficult for the lubricant of the average particle diameter which is less than this lower limit, handling nature also falls.

[0093] As for lubricant 5, it is desirable that it is especially the thing containing fluoridation carbon also in powder lubricant which was mentioned above. When what contains fluoridation carbon as lubricant 5 is used, an advantage as shown below is acquired.

[0094] 1. Especially the lubricant 5 containing lubricative fluoridation carbon has the outstanding lubricity. Therefore, by using such lubricant 5, curve resistance can be reduced effectively and, moreover, each part material can be effectively protected from damage by friction.

[0095] 2. The chemical-resistant insertion part 2 may be immersed in medicine, such as an antiseptic, before and after use. It reacted with such a medicine, and it deteriorated to conventional lubricant, or was corroded, and there were some which cannot bear long-term use in it.

[0096] On the other hand, the lubricant 5 containing fluoridation carbon is excellent in chemical resistance. For this reason, even if lubricant 5 contacts such a medicine, it deteriorates and it does not deteriorate easily.

[0097] Therefore, it becomes possible to use the endoscope 1 which has such lubricant 5 over a long period of time also under the environment where medicine, such as an antiseptic, is contacted daily, without deteriorating.

[0098] 3. The advanced sterilization which used the hydrogen peroxide system antibacterial etc. is presented with the water-repellent insertion part 2. This hydrogen peroxide system antibacterial permeates the inside of the insertion part 2 easily, and tends to be adsorbed by rubber, resin, etc. For this reason, when such sterilization was repeated and presented with the insertion part 2, there was a problem that the member in the insertion part 2 deteriorated gradually.

[0099] However, the lubricant 5 containing fluoridation carbon has the outstanding water repellence. For this reason, if such lubricant 5 is used for the insertion part 2, a hydrogen peroxide system antibacterial etc. becomes difficult to permeate an inside, and can prevent degradation of each part material.

[0100] Therefore, such an insertion part 2 repeats advanced sterilization, and becomes difficult to deteriorate as a line, and such sterilization can be repeatedly presented with it.
[0101] 4. Since the lubricant 5 containing insulating fluoridation carbon has electric insulation, there is no restriction in the place which can be used in the insertion part 2, and it can be widely used for it. And thereby, the insulation of the insertion part 2 whole can be raised.
[0102] A short circuit etc. is not caused, when lubricant 5 is especially used for an electronic endoscope, for example, even if lubricant 5 exists around the terminal area of a lead, a lead, and CCD etc. And a short circuit, an electric shock, etc. can also be prevented.
[0103] Thus, the lubricant 5 containing fluoridation carbon has said four outstanding advantages, and the outstanding endoscope 1 which is later mentioned by the synergistic effect is offered.
[0104] Although the value in particular of n of fluoridation carbon ((CF) n) is not limited, ten to about 100 are desirable, 20 to about 70 are more desirable, and 30 to about 40 are still more desirable. It is because it may become inadequate in respect of water repellence if sufficient lubricity cannot be obtained if the value of n exceeds the upper limit of this range, and it is under a lower limit.
[0105] Moreover, although the average molecular weight in particular of fluoridation carbon is not limited, since it is the same as that of the above, 300 to about 3500 are desirable, 600 to about 2500 are more desirable, and 900 to about 1200 are still more desirable [an average molecular weight].
[0106] In addition, lubricant 5 may contain half-solid carrier fluid, such as silicone gel and grease, oil, etc. Especially, lubricity is not only obtained as lubricant 5 is the thing containing half-solid carrier fluid, but handling becomes easy. Furthermore, it also becomes possible to protect each long member of the insertion part 2 from a shock etc.
[0107] By making the enveloping layer 4 which was described above, and lubricant 5 coexist, the effect of an enveloping layer 4 and the effect of lubricant 5 act synergistically, and the especially excellent effect is acquired. That is, since the lubricity which was especially excellent by making an enveloping layer 4 and lubricant 5 coexist is obtained, friction between each long member produced when incurvating the insertion part 2 is controlled, and damage to each long member and breakage can be prevented.
[0108] And the insertion part 2 excellent in chemical resistance can be obtained. Therefore, even if the insertion part 2 is exposed to medicine, such as an antiseptic, it does not deteriorate easily, and it becomes possible [presenting the sterilization, the sterilization, etc. using medicine etc. repeatedly].
[0109] Furthermore, since an enveloping layer 4 has high water repellence and gas barrier nature, even when the substance which permeates insides, such as a hydrogen peroxide system antibacterial, easily performs sterilization, sterilization, etc., this substance becomes

difficult to permeate an inside. For this reason, the insertion part 2 repeats the advanced sterilization which used the hydrogen peroxide system antibacterial etc., and becomes difficult to deteriorate as a line.

[0110] Moreover, since the enveloping layer 4 has chemical resistance, water repellence, and gas barrier nature, it becomes possible from the exterior to make thin the outer cover 382 and the inner skin 381 which prevent that medicine etc. permeates the insertion part 2. This becomes possible to narrow-diameter-ize an endoscope.

[0111] Such an effect will become still more remarkable by choosing lubricant 5, the component of an enveloping layer 4, etc. suitably.

[0112] As mentioned above, although the endoscope of this invention was explained, this invention is not limited to this.

[0113] For example, the part which arranges an enveloping layer 4 and lubricant 5 is not restricted to the part mentioned above. For example, an enveloping layer 4 and lubricant 5 can be arranged on other parts like the sliding part in the Rheydt guide flexible tube 9 or a final controlling element 7. Moreover, you may form an enveloping layer in the inside of the tube 33 for forceps insertion, the inside of the tube 34 for ****, the inside of the tube 35 for liquid sending, etc. Moreover, it can limit only to the specific portion of each part which mentioned above an enveloping layer 4 and lubricant 5, and can also allot. Furthermore, the conditions (for example, composition of a component, thickness, etc.) of the enveloping layer 4 may differ from the conditions (for example, composition of a component, particle diameter of powder lubricant, etc.) of lubricant 5 by each part.

[0114] Moreover, the number of a wire 36 may not be one pair (i.e., 2), as mentioned above. For example, one is sufficient as the number of a wire 36, and it may be three or more.

[0115] Moreover, the composition of each part material can be replaced by the arbitrary things which have the same function.

[0116] For example, although the embodiment mentioned above is the optical endoscope which used the optical fiber bunch as an image guide, this invention may be an electronic endoscope which is not restricted to this but contains CCD (image sensor) etc. in the tip part of an insertion part.

[0117] In such an electronic endoscope, since an enveloping layer 4 has insulation, a short circuit, a short circuit, etc. can be prevented, an electric shock can also be prevented further, and an endoscope with higher reliability and safety can be obtained.

[0118] Moreover, although the embodiment mentioned above is an endoscope used for Medical Science Division, this invention may be an endoscope which is not restricted to this but is used for industry.

[0119]

[Working example] Next, the concrete example of this invention is explained.

[0120] 1. The endoscope as shown in drawing 1 - drawing 4 was produced using the fiber endoscope for bronchi "FB-X [15] type" by production (example 1) Asahi Optical Co., Ltd. of an endoscope.
[0121] As lubricant, the powder of fluoridation carbon ((CF) n) was used. n was 30-40 and this fluoridation carbon was 5-6 micrometers in average particle diameter.
[0122] The enveloping layer should consist of poly PARAKISHIRIREN. CVD performed formation of the enveloping layer. The average thickness of the obtained enveloping layer was 1 micrometer.
[0123] (Example 2) The endoscope was produced like the example 1 except the average thickness of the enveloping layer having been 5 micrometers.
[0124] (Example 3) The endoscope was produced like the example 1 except having used the powder of the poly tetrafluoro ethylene (PTFE) which is fluororesin as lubricant. The average particle diameter of this PTFE was 5-6 micrometers.
[0125] (Example 4) The endoscope was produced like the example 3 except the average thickness of the enveloping layer having been 5 micrometers.
[0126] (Example 5) The endoscope was produced like the example 1 except having used the thing which made the silicone gel ("SE1880" by Dow Corning Toray Silicone) 100 weight part distribute a fluoridation carbon ((CF) n) 50 weight part as lubricant. n was 30-40 and this fluoridation carbon was 5-6 micrometers in average particle diameter.
[0127] (Example 6) The endoscope was produced like the example 5 except the average thickness of the enveloping layer having been 5 micrometers.
[0128] (Example 7) The endoscope was produced like the example 1 except having constituted the enveloping layer from poly monochloro PARAKISHIRIREN.
[0129] (Example 8) The endoscope was produced like the example 7 except the average thickness of the enveloping layer having been 5 micrometers.
[0130] (Example 9) The endoscope was produced like the example 7 except having used the powder of the poly tetrafluoro ethylene (PTFE) which is fluororesin as lubricant. The average particle diameter of this PTFE was 5-6 micrometers.
[0131] (Example 10) The endoscope was produced like the example 9 except the average thickness of the enveloping layer having been 5 micrometers.
[0132] (Example 11) The endoscope was produced like the example 7 except having used the thing which made silicone gel ("SE1880" by Dow Corning Toray Silicone) distribute fluoridation carbon ((CF) n) as lubricant. n was 30-40 and this fluoridation carbon was 5-6 micrometers in average particle diameter.
[0133] (Example 12) The endoscope was produced like the example 11 except the average thickness of the enveloping layer having been 5 micrometers.
[0134] (Comparative example 1) The endoscope was produced like the example 1 except not

having formed an enveloping layer.

[0135] (Comparative example 2) The endoscope was produced like the comparative example 1 except having used the powder of the poly tetrafluoro ethylene (PTFE) which is fluororesin as lubricant. The average particle diameter of this PTFE was 5-6 micrometers.

[0136] (Comparative example 3) The endoscope was produced like the comparative example 1 except having used molybdenum disulfide (MoS2) as lubricant. The average particle diameter of this molybdenum disulfide was 5 micrometers.

[0137] 2. The following evaluations were performed using each endoscope obtained by evaluation each example and each comparative example.

[0138] First, the bent side was incurvated by operating the curve control lever of each endoscope. This operation was repeated 100 times and performed. The angle ability in the 100th curve operation was evaluated in accordance with four steps of the following standards.

O : it has the optimal angle ability and the best for the use as an endoscope.

O : it has moderate angle ability and is suitable for the use as an endoscope.

**: Angle ability is slightly large and they are those with a problem to the use as an endoscope.

x: Angle ability is very large and it is not suitable for the use as an endoscope. Or by breakage, the use as an endoscope is impossible.

[0139] Furthermore, it carried out to these endoscopes using gas plasma sterilization equipment ("STERRAD" by Johnson & Johnson Medical K.K.), having applied hydrogen peroxide plasma sterilization for about 75 minutes. After repeating this sterilization processing 300 times and performing it, the bent side was incurvated by operating the curve control lever of each endoscope. The angle ability at this time was similarly estimated as the above.

[0140] These results are shown in Table 1. In addition, the lubricant of each endoscope and the conditions of an enveloping layer are also collectively shown in Table 1.

[0141]

[Table 1]

表 1

	潤滑剤	被覆層		アングル力量	
		構成材料	平均厚さ（μm）	滅菌前	滅菌後
実施例1	フッ化炭素	ポリパラキシリレン	1	◎	◎
実施例2	フッ化炭素	ポリパラキシリレン	5	◎	◎
実施例3	PTFE	ポリパラキシリレン	1	○	○
実施例4	PTFE	ポリパラキシリレン	5	◎	◎
実施例5	フッ化炭素＋シリコーンゲル	ポリパラキシリレン	1	◎	◎
実施例6	フッ化炭素＋シリコーンゲル	ポリパラキシリレン	5	◎	◎
実施例7	フッ化炭素	ポリモノクロロパラキシリレン	1	◎	◎
実施例8	フッ化炭素	ポリモノクロロパラキシリレン	5	◎	◎
実施例9	PTFE	ポリモノクロロパラキシリレン	1	○	○
実施例10	PTFE	ポリモノクロロパラキシリレン	5	◎	◎
実施例11	フッ化炭素＋シリコーンゲル	ポリモノクロロパラキシリレン	1	◎	◎
実施例12	フッ化炭素＋シリコーンゲル	ポリモノクロロパラキシリレン	5	◎	◎
比較例1	フッ化炭素	－	－	△	△
比較例2	PTFE	－	－	×	×
比較例3	MoS_2	－	－	◎	×

[0142] Each endoscope of this invention has the outstanding curve nature, and the curve nature which was excellent even after carrying out by repeating sterilization processing was maintained so that clearly from Table 1.

[0143] On the other hand, the endoscope of the comparative example 1 and the comparative example 2 was inferior to curve nature. Moreover, although the endoscope of the comparative example 3 had the curve nature which was excellent before performing sterilization processing, it produced the rent to the outer cover and the inner skin of the insertion part by repeating sterilization processing and performing it.

[0144]

[Effect of the Invention] As stated above, even if curve resistance is small and uses it repeatedly, according to this invention, the endoscope which does not produce damage and breakage easily can be obtained.

[0145] Moreover, since it excels also in chemical resistance, an endoscope with repeatable advanced sterilization etc. can be obtained. Moreover, since it excels in insulation etc., it is applicable also to an electronic endoscope.

[0146] Moreover, since it has chemical resistance, water repellence, and gas barrier nature excellent in the enveloping layer, it becomes possible from the exterior to make thin the outer cover and the inner skin which prevent that medicine etc. permeates an insertion part. This becomes possible to narrow-diameter-ize an endoscope.

[0147] Such an effect will become still more remarkable by choosing lubricant, the component of an enveloping layer, etc. suitably.

[Translation done.]

Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the whole figure showing the embodiment of the endoscope of this invention.
[Drawing 2] It is the transverse cross section of the insertion part in the endoscope shown in drawing 1 .
[Drawing 3] It is the longitudinal section of the bent side in the insertion part of the endoscope shown in drawing 1 .
[Drawing 4] It is the expanded sectional view expanding and showing a part of longitudinal section shown in drawing 2 .
[Explanations of letters or numerals]
1 Endoscope
2 Insertion Part
20 Flexible Tube
21 Bent Side
22 Tip Part
23 The Latest Part
24 Outside Pipe
31 Image Guide
311 1st Protection Tube
312 2nd Protection Tube
32 Rheydt Guide
321 Protection Tube
33 Tube for Forceps Insertion
34 Tube for ****
35 Tube for Liquid Sending
36 Wire

37 Wire Insertion ****
381 Inner Skin
382 Outer Cover
39 Object Lens
4 Enveloping Layer
5 Lubricant
6 Optical Fiber
7 Final Controlling Element
71 Final Controlling Element Main Part
72 Final Controlling Element Cover
73 Curve Control Lever
8 Eye Contacting Part
9 Rheydt Guide Flexible Tube
10 Connector

[Translation done.]